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—EDITOR.

Agricultural Journal

VOL. 20 MARCH, 1949 NO. 1

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EDITORIAL . . .

SEVENTH PACIFIC SCIENCE CONGRESS

In these days of doubts and fears as to the future progress of the world, it is indeed encouraging and hopeful that international scientific organisations are still concerned with the advance of knowledge and culture in the service of mankind.

Of such a nature was the Seventh Pacific Science Congress of the Pacific Science Association which was held in New Zealand recently. Scientists attended from all parts of the Pacific area—from Indonesia, Hawaii, the Philippines, New Caledonia, Samoa, Fiji, U.S.A., Australia, and Canada. Delegates came also from the European countries of Holland, France and the United Kingdom to swell the ranks of the local representatives of Colonial territories.

Whereas the origin and scope of the Pacific Science Congress is fairly well understood in the South Pacific, it is doubtful if its influence in shaping policy, and research programmes, has been so clearly appreciated. Fundamentally, the Pacific Science Association is concerned with the acquirement and dissemination of scientific knowledge, and with the application of such knowledge to the health and social welfare of the peoples of the Pacific area. In normal circumstances full Sessions occur at intervals of three years in chosen centres in the Pacific; papers are contributed by Pacific scientists, discussion on these papers takes place and recommendations are adopted and promulgated. During the interim period between Sessions progress in the several fields is covered by Standing Committees selected at the previous Session.

At the Seventh Session of the Congress the programme covered the fields of Geology and Geophysics, Meteorology, Oceanography, Zoology, Botany, Soil resources, Forestry and Agriculture, Anthropology, Public Health and Nutrition, Social Sciences and the organisation of research. In all 583 papers were contributed by 498 scientists, apart from equally valuable contributions made in the course of scheduled discussions. The present meeting was of particular interest to the Colony of Fiji because of its closeness to our own territory and on account of the invitations to attend which were extended to certain new organisations which had arisen since the last meeting of the Congress in San Francisco in 1939. These new bodies included the South Pacific Commission and the South Pacific Health Service, the activities of which are of immediate concern to the Colony. Certain specialist agencies of the United Nations, particularly the Food and Agriculture Organisation and the Economic Commission for Asia and the Far East also sent representatives.

Above all, for the first time since the inception of the movement in Honolulu in 1920, Fiji was directly represented by her own scientific delegates who not only contributed scientific papers in their own particular fields, but also took part in the formal and informal discussions culminating in agreed proposals and recommendations to the 48 participating Governments.

There is no doubt that the Colony has derived considerable benefit from the attenddance of her delegates at the Congress. Our representatives in the fields of the Social Sciences, Anthropology, Public Health and Nutrition, were able to direct the attention of delegates to the system of Government and Social Services which in the light of our long Colonial experience and the special problems of the South Pacific are deemed desirable for the Colony. In these days of experiments in Government, education and related Social Services such contributions based on a solid background of achievement are of great value in shaping sound policy. On the other hand the contributions made by other participating Governments will be of interest to Fiji where modification of our own policy appears desirable.

The Department of Agriculture was represented by the Deputy Director, Senior Agricultural Officer, Veterinary Officer and Entomologist; papers prepared by the Director of Agriculture, the Soils Chemist and the Conservator of Forests were also presented. The meetings of the sections concerned with the Soil Resources, Forestry and Agriculture, Botany and Zoology were of considerable interest and value, and papers and discussions covered a wide range of topics, including Soil Classification and Survey, Soil Conservation and Fertility,

Conservation of natural Fauna and Flora, Livestock improvement, Economic Entomology and Systematic Botany and Zoology. It would be impossible to cover adequately in any brief review the wealth of information which was presented to the Congress, but aspects of more particular interest to Fiji will be dealt with from time to time in the pages of this *Journal*. Of special value to our delegates was the opportunity afforded of meeting scientists of world reputation and discussing with them problems of common interest and new scientific methods and techniques which have application to such problems. In this section also the Fiji delegation were able to make solid contributions on such matters as changing agricultural conditions in the South Pacific, agricultural co-operation, agricultural policy and research, biological control of weeds and insect pests of economic crops, botanical studies, development of the dairy industry and soil science studies.

This first post-war meeting of Pacific scientists was in several respects different from those which had preceeded it. Since the last meeting in 1939 the world had passed through a calamitous war in which Pacific countries were largely involved. In the circumstances the work of the Pacific Science Association, devoted as it is to acquirement of knowledge for the development of Pacific territories had to give way to the stark necessity of preserving that knowledge and culture which had already been acquired—the natural sciences had to make way for the physical sciences distorted to the ends of War. To some extent therefore the Seventh Congress was of the nature of a stocktaking—a free interchange of information, the definition of the task ahead, and the formulation of programmes of work. The need for continuity of effort in the period between Sessions was clearly indicated by the unanimous support given to the proposal for the establishment of a permanent secretariat and secretary-general.

It was obvious also that delegates were especially concerned with the present world position of increasing populations and diminishing food supplies. It appeared to the writer that the dominating outlook of the Congress in the fields of Soil Resources, Agriculture and Forestry, and related natural sciences, was one of conservation along the lines of improved agricultural practices—directed to the maintenance of soil fertility and increased production—and the planning of development in terms of the natural environment and approved soil conservation practices. This outlook was not academic in nature; it was essentially practical and dictated by the urgent need for remedial measures while opportunity for restoration and improvement still remains economically possible. No new ideas were advanced nor academic theories formulated; insistence was placed on the immediate application of approved practical methods of conservation. —W.J.B.

STAFF NOTES.

Mr. J. O. Gillmore, Grade II Clerk, resigned with effect from 18th February, 1948, in order to take up his new duties at the Native Land Trust Board's office.

Mr. L. E. Smythe, M.Sc., resigned from the post of Soil Chemist with effect from 19th February, 1948, Mr. Smythe will take up an appointment at Hobart University.

Mr. J. W. Parham, Laboratory Assistant, was granted 12 months' leave of absence as from 1st March and proceeded to Auckland, New Zealand, early in March to attend Auckland University College.

On 14th March Mr. B. E. V. Parham, Senior Agricultural Officer, relinquished at his own request the duties associated with his appointment as Acting Economic Botanist which he has carried out since 23rd April, 1947.

Miss M. E. Turbet, B.Sc. (N.Z.), was appointed temporary Laboratory Assistant as from the 21st March and took up her duties as from that date.

Mr. J. W. Gittins, M.A. (Oxon.), was appointed Registrar of Co-operatives on 10th January and took over his duties from Mr. B. E. V. Parham who has been acting Registrar of Co-operatives since September 1947.

Miss P. Anning, Temporary Clerk, resigned with effect from 1st April.

Filimone Raiqiso was promoted to the post of Agricultural Assistant with effect from 1st January, 1949. He is to be congratulated on being the first Fijian officer to be appointed to serve in this capacity.

The appointment of Mr. K. J. Garnett as Veterinary Officer has been confirmed.

AGRICULTURE . . .

BRITISH TRACTORS AND ASSOCIATED EQUIPMENT

BY M. D. FFRENCH-MULLEN

[*Within recent years farmers in Fiji have evinced a growing interest in tractors and tractor implements. This interest has been aroused not only by the considerable developments that have taken place in tractor and associated implement design—particularly in the evolution of lower priced, smaller powered units,—but also by the appreciation that mounting labour costs and the need for improved farming methods are demanding mechanical assistance on farms.*

In this first paper the author surveys the tractor field with particular reference to British types ; in subsequent papers the performance of certain tractor types (approved by Agricultural Advisory Council) will be described. EDITOR.]

Since the war the dollar position has precluded the purchase of the popular Caterpillar D2 or other American crawler tractors of similar horse-power, save in exceptional circumstances. While on leave in the United Kingdom in 1948, the writer was instructed to investigate tractor types of British manufacture which might prove suitable under field conditions in Fiji.

The crawler tractor is generally regarded as being the most suitable tractor for local conditions. Undoubtedly the crawler tractor is most suited to the wet zone, judged on the basis of the number of days the tractor, when loaded, could move over the ground as compared with a wheel tractor. However, ploughing or cultivation should not be carried out when land is too wet and one may find that for all normal cultivation requirements in the wet zone, a wheel tractor might be satisfactory. The farmer would have to choose his weather more strictly than he does at present, which, in the long run, is more desirable.

In the dry zone, wheel tractors should be quite satisfactory for all normal farm requirements. Moreover, the initial cost of a wheel tractor is considerably less than that of a crawler of the Caterpillar D2 type although the horse-power is generally lower than that of the D2. The considerable reduction in capital outlay makes the wheel tractor more accessible to a group of small farmers or enables a larger farmer who could not contemplate the outlay required for a D2 consider the purchase of a tractor for his own use and for contract work.

At the present time there are four types of crawler tractors manufactured in Britain and a large number of four-wheel tractors, of which the most popular is, perhaps, the Fordson Major due primarily to its low initial cost. In addition, a wide range of two-wheel "baby" tractors is produced, mainly suitable for small holdings which are intensively worked. Most manufacturers of tractors are associated with various implement firms as a result of which, ploughs, tool-bars, saw benches and trailers, suited to the particular make of tractor can be obtained with the tractor.

BRITISH CRAWLER TRACTORS.

In view of the local preference for crawler tractors, brief notes on four types of crawlers manufactured in Great Britain are given below.

(*a*) *The Fowler-Marshall Diesel Crawler Tractor.*

The production of the pre-war Fowler crawler tractor has ceased and a Fowler crawler tractor is now on sale powered with a Marshall cartridge started diesel engine. This tractor is fitted with the same engine as is in the Field-Marshall wheel tractor. The engine is of unusual type being a single cylinder horizontal full diesel. It develops 40 belt horse-power and is about equivalent to a Caterpillar D4 in power output. The tractor has the advantage of having a small number of working parts and in consequence maintenance is simple. It has an unusual feature in the development of a dirty exhaust when the engine is overloaded.

When this occurs the governor control must be closed to avoid the risk of engine seizure.

One of these tractors has been purchased by the Public Works Department and is on road maintenance work in the Western District.

(*b*) *The "County" Crawler Tractor.*

This crawler tractor is powered with a standard Fordson Major engine, giving 35 b.h.p. when running on petrol. It is of recent development and according to information available at present is not quite as powerful as a Caterpillar D2. Further information is being sought on its performance and as to whether it is possible to fit a diesel engine in place of the petrol engine as is possible with the Fordson Major Tractor. The cost ex-works in the United Kingdom is quoted as £Stg.765 in the *Farm Implement and Machinery Review.*

(*c*) *The Bristol "20" Crawler Tractor.*

The new model of the Bristol tractor develops 22 b.h.p. as compared with about 10 b.h.p. in the previous model. The power unit is an Austin industrial engine burning petrol or vapourising oil. The tracks are rubber jointed which, it is claimed, reduces wear. A 2-furrow plough and tool bar frame with assorted fittings can be obtained with the tractor and a rotary hoe cultivator is being developed for attachment to it. The tractor can be fitted with an angledozer but this has to be purchased as a complete unit. No details of local retail costs are available at present. The price of the tractor ex-works in the United Kingdom was quoted in August 1948 as £Stg.495.

The Agricultural Advisory Council has recommended the purchase of one of these tractors with associated equipment for trial. It is hoped that this tractor will arrive early in 1949.

(*d*) *The Ransomes M.G.5 Crawler Tractor.*

This tractor supersedes the MG2 and is of 7 b.h.p. and is therefore more powerful than the previous model. It can be classified as a "baby" tractor. One MG2 is already in Fiji in the possession of the Education Department. The cost of the MG5 is reported to be the same as for the previous model and it has associated with it a complete range of attachments including a self-lift trailing plough, tool-bar frame with associated attachments and a spray pump.

On the arrival in the Colony of the MG2 tractor with associated equipment some two years ago, observations were made on its performance at Nasinu under conditions which the tractor was not designed to meet. It appeared that under market garden or similar conditions the tractor would do a good job of work but that it was impossible to expect it to plough out heavy land efficiently. It cannot be expected to perform the work of a 20 horse-power tractor.

BRITISH WHEEL TRACTORS.

Brief notes on four makes of four-wheel tractors and on two makes of two-wheel "baby" tractors are submitted.

(*a*) *The Field-Marshall 4-Wheel Tractor.*

This tractor is powered with the same engine as is the Fowler crawler tractor. The power developed is about 40 belt horse-power and the performance is similar to that for the crawler save that the tractor is on wheels. The tractor has a tendency to vibrate more than is usual for wheel tractors when idling. The tractor approximates to the Caterpillar D4 being more powerful than the Caterpillar D2.

A few of these tractors are in use in East Africa. Reports on their performance are generally favourable particular mention being made of the ease of maintenance.

(*b*) *The Fordson Major 4-Wheel Tractor.*

This tractor may be fitted with an engine burning petrol or vapourising oil or it may be fitted with a Perkins diesel engine instead of the standard type engine, with a corresponding increase in capital cost. The standard petrol engine delivers 35 belt horse-power while the engine burning vapourising oil delivers about 6 belt horse-power less.

Three types of tractors are available.—

1. The Agricultural Model equipped with steel wheels.
2. The Land Utility Model equipped with rubber wheels.
3. The Row-Crop Model.

Further, any of the above models can be equipped with Roadless DG Half-Track equipment at additional cost. The fitting of Half-Track equipment results in an improved drawbar pull of about 25 per cent on that for the wheel tractor.

The approximate local retail costs of types 1 and 2 above, fitted with a petrol engine is £F450 and £F500. The substitution of the diesel engine would add approximately £F400 to the cost of each type and the substitution of the steel rear wheels by Half-Track equipment in type 1 above would add approximately £F350 to the initial cost.

A full and wide range of equipment for use with the Fordson Major is available, which includes 3-convertible to 2-furrow ploughs, tool-bar frame with assorted attachments, saw bench, earth moving equipment, trailers, winches, etc.

The Department of Agriculture has procured a Land Utility Model with Bower wheel attachments for testing purposes and use on agricultural stations. Steel wheels and Half-Track equipment as well as other associated equipment are to be ordered for trial.

A few Fordson Major Land Utility or Agricultural Model tractors have recently been purchased by farmers. In the Tailevu dairy area a Land Utility Model equipped with Bower wheel attachments operated a " Roma " cut-away scrub disc plough satisfactorily in wet pasture. The Bower wheels materially assisted traction on wet land. A similar model has pulled satisfactorily a 3-furrow 28-inch disc plough at the Principal Agricultural Station when cross ploughing to a depth of about 10 inches during the running-in period of the tractor. It is perhaps too early to comment but it appears that a petrol driven Agricultural Model or Land Utility Model with Bower wheel attachments should handle a 2-furrow 28-inch disc plough ploughing to say a depth of 10 inches on most soils in the Colony which are in a reasonable condition for working. A tractor equipped with Half-Tracks should handle a 3-furrow plough under similar conditions.

The Fordson Major is not as powerful as the Caterpillar D2 but is more powerful than the Bristol " 20 ". When more experience has been obtained of its performance under local conditions the Fordson Major may find favour in the Colony in view of its low initial cost and the power available.

(*c*) *The Ferguson 4-Wheel Tractor.*

This is a tractor with a Standard petrol or vapourising oil engine. It is equipped with a wide range of associated equipment and should prove satisfactory under local conditions.

Efforts made by the local agents to procure a tractor for trial at the request of the Department of Agriculture have so far met with no success. This tractor has found favour in the " hard currency " areas as well as in Europe, a fact which, coupled with the reported policy of the Company not to send tractors to areas where there are no personnel trained in the maintenance of their machines, has resulted in no Ferguson tractors being available for Fiji.

The Agricultural Advisory Council has recommended that a Ferguson tractor be tried out in the Colony and it is hoped that one may be procured in 1949.

(*d*) *The David Brown 4-Wheel Tractor.*

This is a smaller tractor than those mentioned above. It has a maximum belt horse-power of about 20. The Bristol " 20 " is only slightly more powerful but has the advantage of being a tracklayer which results in a greater drawbar pull under general farming conditions.

The Agricultural Advisory Council has recommended that one of these tractors be purchased for trial under local conditions.

(*e*) *The Trusty 2-Wheel Tractor.*

This is a 6 horse-power tractor fitted with steel or rubber wheels. It is a walking tractor in the sense that one cannot ride on it. All controls are on a pair of handles. It is equipped with a full range of equipment including a small disc harrow.

This tractor is comparatively cheap and is of use in market gardens and on small farms requiring intensive working. The writer operated one of these machines when it was ploughing on sloping grassed land and found that there was a knack in the handling of the machine when in work and that they were most tiring on the operator. One of these tractors, with equipment, is to be obtained for trial purposes.

(*f*) *The Plowmate 2-Wheel Tractor.*

This is a 6 horse-power tractor similar to the Trusty mentioned at (*e*) above. One is to be obtained, with associated equipment, for trial on the recommendation of the Agricultural Advisory Council.

ASSOCIATED EQUIPMENT.

As has been mentioned previously, most British tractors have associated with them types of farm machinery developed for fitting to the particular tractor. The manufacturers of the tractor recommend the equipment and therefore one can obtain equipment suited to the tractor at the same time as an order is placed. It must be pointed out that such equipment is suited to United Kingdom farming conditions and could not be recommended to the farming community without prior testing under local conditions save under special circumstances. The Agricultural Advisory Council has recommended to Government the purchase of certain wheel and crawler tractors with their associated equipment for testing under local conditions by the Department of Agriculture. This recommendation has been accepted and it is hoped that in 1949 most of the tractors mentioned above will have been imported.

Most of the tractors mentioned in the foregoing can be fitted with hydraulic lift equipment. In fact in certain of them this is standard equipment and all associated equipment is coupled to it. In the latter case a standard swinging draw bar for trailing implements is extra equipment. The main advantages of mounted or attached implements are that the implement can be moved around easily without fear of damage from metal roads, that the field headlands may be narrower and odd shaped fields can be more efficiently and easily worked. Further, hydraulic equipment facilitates the use of mid and forward mounted tool-bars equipped with cultivating tines, ridger bodies and sweeps.

The main advantage of mid and forward mounted tool-bars is that such mounting enables much more accurate inter-cultivation as the tractor operator can see what he is doing without turning round. The general trend is towards mid and forward mounted tool-bars.

The range of equipment at present offered by manufacturers of certain tractors is wide, particularly for the Fordson Major and Ferguson. All ploughs are of the mouldboard type with the option of general purpose or semi-digger mouldboards. Local experience, including that on stations of the Department of Agriculture, has indicated that the disc plough, particularly if equipped with scrapers, makes a good job of ploughing under a heavy weed growth or cane trash. The mouldboard plough will generally turn over and bury light weed or grass cover more effectively than a disc plough which tends to break up the furrow slice. Therefore it may be possible to use effectively the ploughs developed for use with the wheel tractor. Disc harrows are more the exception than the rule in manufacturers' lists of equipment associated with their tractors. The tool-bar frame either rear, mid or forward mounted is designed to take rigid harrow tines, spring-toothed tines, steerage hoes, and ridger bodies. In addition, mounted circular saws driven off the tractor belt pulley can be obtained as well as power mowers and winches driven from the power take-off. Trailers, either two or four wheel, mounted or unattached are available. Rotary hoe attachments and earth moving equipment are available for certain tractors.

Most of the tractors are fitted with power take offs as well as pulleys enabling grinding mills, chaff cutters and pumps to be driven by the tractor.

Most wheel tractors can be fitted with Roadless DG Half-Track equipment resulting in an increase in the drawbar pull. The fitting of this equipment results in an increase in the capital cost of the tractor.

In conclusion, it must be emphasised that at the present time few of the British-made wheel or crawler tractors are or can be fitted with a diesel engine. Petrol is admittedly a more expensive tractor fuel but the initial cost of a petrol tractor is much below that of a diesel tractor of equivalent horsepower. The use of vapourising oil is dangerous unless the tractor is to be owner driven or operated by a reliable driver for the reason that immediately a tractor working on vapourising oil cools down when

idling the combustion of vapourising oil becomes incomplete and runs down into the sump. If the tractor is not switched to petrol on cooling down when idling and vapourising oil becomes admixed with the engine oil serious damage may result if the engine is run for any length of time with the lubricating oil diluted. The fuel cost of petrol tractors in Fiji is somewhat reduced owing to the rebate obtainable on duty paid on petrol used solely for agricultural purposes.

THE DECEMBER HURRICANE

The hurricane which passed through the Fiji group early in December first struck the island of Rotuma; and then, following a course of approximately S.S.East, the core of the storm swept the north-eastern tip of Vanua Levu, the islands of Rabi and Taveuni, and continuing on its course, almost completely devastated the greater portion of the Lau group. Damage in Lau was so severe that His Excellency the Governor immediately formed a committee for the organisation of relief by air to those islands most urgently in need. The Officer Commanding the R.N.Z.A.F. base at Laucala Bay (Squadron Leader J. Checketts) readily offered to supply aircraft and personnel; and the Department of Agriculture was allotted the task of obtaining and packing emergency rations.

Weather conditions prevailing rendered a landing quite impossible at many islands and difficulty was at first experienced in finding a method of pack which would withstand the drop without parachutes. After experimental drops were made in the Suva area, a satisfactory pack was devised, and with officers of the R.N.Z.A.F. and the Department of Agriculture working almost round the clock, a total of 29,148 lb of emergency rations was distributed to islands in the Lau group, within four days.

Food crops on islands which were in the direct path of the storm were completely ruined and coconut plantations so severely damaged that it will be several years before these again reach full production. In Lau much damage was caused to houses and copra drying equipment and it will be many months before the people of these islands complete the huge volume of work, in rebuilding and planting, that lies ahead of them.

The south-eastern portion of Vanua Levu, Lomaiviti and Viti Levu all suffered damage from the action of high winds, but fortunately the severe floods which, on occasions, are part and parcel of Fiji hurricanes, did not eventuate and apart from a few gardens situated close to river banks, flood damage was small.

On the island of Viti Levu, the crops most seriously damaged were bananas and tapioca. The winds experienced in banana growing areas, although severe, were not of sufficient force to wipe out plantations and losses will therefore be only of a temporary nature. It is estimated that damage caused to foliage and root systems will result in a 15 per cent to 20 per cent decrease in production during the next six months.

Advanced tapioca plantings which were in exposed positions suffered considerable damage, but much of this will not become apparent until the crop is harvested during coming months. Advanced tapioca plants present a large surface of wind resistance and if high winds are experienced the consequent disturbance to the root system frequently results in the crop being inedible.

—R.A.K.

POTATOES 1948

The Field Officer Western reports that excellent yields of potatoes were obtained from plantings made during 1948 and the bulk of the crop was sold during the last quarter. Yields in excess of 10 tons per acre were obtained from well-grown crops.

Practically all the Fijian grown potatoes passed through the hands of the Nadroga-Navosa Co-operative Association Limited, a union of four member societies,—the price being set at £20 per ton at Sigatoka for graded potatoes only. Co-operative members were given instruction in grading and this was supervised by Field staff of the Department of Agriculture. This proved well worth while and the bulk of the crop was readily disposed of to local merchants who accepted the fixed price for the season because of the guarantee of quality. It is hoped that this arrangement will be maintained during 1949.

PEN MANURE

Since 1946 the Department of Agriculture has endeavoured to interest small farmers in the preparation of pen manure and compost by means of stall feeding and bedding down of cattle. It was not anticipated that this project would receive much support but progress has been made and a full report will be published. An example of the experience of Departmental officers is contained in a report by Field Officer Western who states that although four pen manure sheds were constructed in four centres over a year ago and frequent inspections made, the results to date have been disappointing. Of the four sheds two have ceased to exist, one is worked half-heartedly and one is being very efficiently utilized. One of the difficulties met with is the fact that in the drier areas where pen manure is so vital to economic farming, supplies of timber and thatch for construction of pens and shelters are extremely scarce and this is a strong initial deterrent to pen manure shed construction by Indian farmers. Of six pens constructed in Ba Province the Agricultural Officer Western reports that five are working well or very successful, but the main trouble has been the lack of trash for bedding and the drying out of the material in windy weather. In general the response of Indian farmers to the idea of producing manure is disappointing but it is hoped, by continual encouragement, to obtain gradually improving results.

B.E.V.P.

BANANAS FOR CANADA

The first post-war shipment of bananas from Fiji to Western Canada was sent forward on the R.M.S. *Aorangi* which left Suva on 28th August, 1948. Owing to the fact that the M.V. *Matua* loaded bananas for New Zealand only two days earlier, several shippers were unable to provide fruit for Canada with the result that only 293 bunches and 48 cases were forwarded by two shippers.

The prices realized in Vancouver were 9 cents per pound for bananas on stems and 11 cents per pound for those in cases. The price of Central American bananas (stems) at the time was 10½ cents per pound.

This shipment arrived at a time when the market was out of bananas and the prices realized were higher than those received for subsequent shipments. These were as follows:—

	Per pound.
October shipment	.. Stems 8½ cents.
	Cases 5⅓ cents.
January shipment	.. Stems 8 cents.

On the first shipment the shippers decided to pay a retrospective bonus of 1s. per bunch to growers and to increase the price to 4s. per bunch for the next two shipments.

The official agents in Vancouver (Messrs. Oppenheimer Bros. and Company) have provided most valuable reports on these early shipments and have taken a great interest in conditions affecting the proper transport, storage and ripening conditions for Fiji fruit. They have emphasized the need for careful selection and handling and commented that scab-moth blemish and bruises were greatly improved in the later shipments. The flavour and quality were favourably reported upon.

The shipments are being continued in spite of difficulties associated with the periodicity of shipping. It is considered that there are good prospects of improving the quality of bananas grown in Fiji provided the incentive of regular and adequate shipments is maintained. Up to the present, the interval between the New Zealand consignments per *Matua* and those for Canada per *Aorangi* has been too short to give shippers a reasonable opportunity to increase the quantity of first class fruit purchased. The continuance of shipments to Canada will improve the economics of the banana industry and make possible more adequate attention to field cultural and disease control operations. —B.E.V.P.

A SOIL CONSERVATION PROJECT IN NADROGA - NAVOSA

BY C. E. WHITEHEAD

[The most active branch of extension work by Departmental officers in recent years has been that dealing with the Soil Conservation projects approved for action in 1946. *To date, in all districts many farms have been converted to a contour lay-out and crop rotation ; and what is more important, an increasing number of farmers have been each month converted to contour farming and strip cropping as a means of saving the rapidly waning fertility of their soil. During* 1948 *a special project at Uciwai near Momi—36 miles north-east of Sigatoka—was approved. This undertaking was more ambitious than any hitherto attempted and on account of its importance from a practical and propaganda point of view, approval was given for the work to be done at Government expense—the landholder and his tenants assisting with their labour. The project was carried out by the local staff of the Department under the supervision of the Field Officer Western whose report has been abridged to provide the following article. The loan of a tractor and grader by the Public Works Department enabled this project to be carried out in a short time. The success of the work is demonstrated by the fact that many farmers in the district have applied for assistance with a similar lay-out for their farms. In the past six months also the permanent nature and value of the work done has been amply put to the test during an unusually long and wet summer.* EDITOR.]

To impress upon conservative peasant farmers the benefits of any departure from their time-honoured customs, practical demonstrations are essential, and it was accordingly decided to undertake a reclamation and conservation project on a reasonably large scale. The farm selected was at Uciwai in Nadroga Province and comprised 80 acres, of which 70 were under cultivation and 10 in grass, the whole being triangular in shape and bounded by two creeks joining at the apex. The land is very broken, being divided by hills and spurs into nine separate watersheds which have been greatly impoverished by sheet erosion and on which three major gullies were created by storm water.

The object of the work, which commenced in July 1948, was to demonstrate the control of soil erosion on the 80 acre farm by constructing low base terraces, contour bunds, pasture contour sod furrows and gully dams, and to institute for the farmer a system of contour cultivation and strip cropping.

DESIGN AND LAYOUT.

After a preliminary survey, the area was divided into 10 separate sections for contouring, each section being entirely independent in layout. This necessitated the closing of two road-ways, and the constructing of a road-way along the main spur running through the property. A gradient of 1 to 180 was decided upon for the fall along the low base terraces. At terrace outlets this was increased to 1 to 90. Where possible terrace falls were reversed at convenient points so that the water was carried away in both directions. One contour drain was surveyed with a gradient of 1–180 increasing with distance to 1–90. The two main head-drains installed were given a fall of 1–90 for the entire distance. Contour bunds were surveyed with a gradient of 1–180 and on true contour.

Pasture sod furrow contours were surveyed on the true contour, with 5 foot verticals. Vertical distances between contours were determined according to the percentage slope of the land, and the vertical heights were pegged out along the line in each section which ran from the lowest to the highest point of that section. Contour verticals ranged from 1′ 6″ to 7′, inter contour distances from 15 to 60 yards, percent slope of the land from 1 to 16 per cent. The average vertical given was 6′, and the percent slope was, on the average, in excess of 6 per cent. Consideration had to be given however, to the wide variation in the natural contour of the land, and in instances verticals were determined by this factor alone. For instance, a spur of land along the survey line would indicate a 7′ vertical, but this spur rapidly falls away to a flat with a percent slope of 4 per cent or less.

Average percent slopes of land, and inter contour distances can only be obtained by a complete mapping of the whole layout. When surveying contour lines, consideration was also given to the practical working of the inter contour areas.

CONTOUR CONSTRUCTION.

Low base terraces were constructed by moving the earth from the upper side only. There is no doubt that this is the most suitable method of terrace construction on steep land such as was encountered. On easy workable deep soils this type of terrace can be installed in $3\frac{1}{2}$ rounds, or seven trips with a grader with a 10 feet blade. On more difficult soils additional trips are required until the terrace is of right construction. The terraces were constructed by cutting with the toe of the blade along the pegged line, and throwing soil down hill (this determines the position of the bottom of the terrace drain); back cutting with the entire blade and throwing soil into the drain bottom; cutting with blade on angle and throwing soil down hill; back cutting up hill from the drain and throwing soil down hill into the drain; cutting with blade on angle and throwing soil down hill; back cutting with entire blade and bevelling slope of drain shoulder, and at the same time throwing soil down into the drain; cleaning out the drain by bevelling soil out of the drain with the entire length of the grader blade. This results in a terrace 16′ wide and a drain 6′ wide and 16 inches deep when measuring from the parallel from the top of the contour bank. The bottom of the drain is located 8′ on the up hill side of the terrace bank centre. A ten foot grader, and a 22 horse power "Caterpillar" tractor were used for the construction of terraces. (Fig. 1).

Fig 1.

General view of the soil conservation unit at work forming low based terraces with gradient of 1: 180. The crop on the slope is Pigeon pea and the incorrectly placed grass bund is Vetiver grass (*Vetivera zizanoides*) previously planted by the occupier.

The contour drain was constructed by cutting along the pegged line with the toe of the grader blade and throwing the soil down hill. Further cuts were made along the same line until the drain was of the desired depth. Back cuts above the drain were made with the blade at an acute angle, and the soil thus removed graded out of the drain and thrown down hill. This back cutting was merely for the purpose of bevelling the drain edge to prevent erosion of the edge, and to clear obstacles immediately above the drain.

The main head drains were constructed in a similar manner to contour drains, but in constructing these drains much greater depth was given. As these main drains were constructed in pasture land, there was no back cutting of the drain edge.

Contour bunds were constructed by making one level cut with the grader blade along the pegged lines and planting Vetiver grass as bunding along the line and immediately below the shoulder of the "table" of the line. (Fig. 2.).

Pasture sod furrow contours were constructed by throwing up a crown along the pegged lines with a single furrow mould board plough drawn by bullocks. The turf sods were arranged by hand where necessary so that there were no breaks in the low walls of the earth thus formed. Where the sod furrows ran into gullies or depressions in the ground, the furrows were blocked off on either side of the breaks. These furrows were constructed on the true contour for the purpose of acting as reservoirs during scanty rain falls and as grids to "step" water down the natural slope, when downpours occurred.

In all four miles of low base terraces were constructed on 65 acres; one mile of contour bunds on seven acres; two miles of pasture sod furrows on ten acres. (Fig. 3).

DAM CONSTRUCTION.

These are to be constructed across the three main erosion gullies which run through the property. Owing to the depth of the gullies it was not practical to fill them in with the grader. They were therefore

Fig 2.
A detailed view of the work in progress at Uciwai—1948.

Fig 3.

General view of one section of the farm showing completed terrace banks. The figures are the author (left) and Dr. K. B. Cumberland of Auckland University College.

utilised in the layout of contours for outlet drains. The conversion of the gullies into drains necessitated the levelling of the gully floors, excavating shoulder abutments of soil so that the bank ran parallel for the length of the drain. Banks were levelled steeply to prevent "under bank" erosion. In locating major dam sites vertical falls were calculated to allow for an 8" drain clearance above the top of the dam. Owing to the very irregular depth of the gullies it was not practical to space dams apart so that the top of one dam was level to the base of the preceding dam.

Minor dams were to be constructed six inches high and are so surveyed that the 8" clearance is maintained. Major dams will consist of a double row of steel stakes three feet apart and running across the dams.

The drain enclosed within the stakes will be trenched to the depth of one foot, the trench extending three feet into the shoulders of the drain on either side. Rice straw, puddle and brambles will be progressively packed down the stakes and wired until the required height is reached. Strainer wires will anchor the stakes in position. Minor dams will be constructed by laying logs in a one foot trench at surveyed points and backed by steel stakes. This work has not been completed owing to the present unavailability of steel stakes. As the drain floor is within a few inches of rock only steel stakes will suffice.

COSTS OF CONSTRUCTION.

Although at the time of writing the gully dams are not completed the estimated cost is included in order to arrive at a complete figure of costs for the finished project. The costs of the various operations were as follows.

(*a*) Low base terraces . .. £47 5 10 £11 15s. 5d. per mile; 14s. 9d. per acre.

(*b*) Contour bunds .. .. £7 9 5 £7 9s. 5d. per mile; £1 0s. 10d. per acre.

(*c*) Pasture sod furrows .. £3 0 4
£1 10s. 2d. per mile; 6s. per acre.

The overall cost of all operations from start to finish, including completion of the gully dams was £103 14s. 3d. which approximates to £14 per mile or 26s. per acre over the whole farm.

The average contouring cost of £1 5s. 11d. compares favourably with contouring costs in other countries, and although perhaps a little high is by no means out of proportion with the type of land the contours were constructed on. This land is typical of most of the Western Division land, and it is unlikely that the land itself will be a factor in reducing costs in future contouring. They could, however, possibly be reduced by the use of more suitable and powerful equipment.

During the course of the construction of contours, the three sub-tenants on the area were busily engaged in ploughing a major part of the farm. Despite the preoccupation of staff in contour construction, it was necessary to tutor these ploughmen in soil conservation lore, and commence them ploughing in the proper contour ploughing way. As opportunity offered, their ploughing was checked, and any tendency on the part of the ploughman to revert to his own centuries-old style, discouraged. It can be said to their credit that at the finish they were enthusiastic to the point of instituting several contour ploughing methods of their own when, during a rush period encountered by staff, their supervision was impossible. Up to the present time, however, they insist on contour ploughing an inter contour space for the whole width, but only a short distance, instead of ploughing the complete contour length for a proportionate inter contour strip. Their worst failing is their habit of ploughing their way in a direct line home at the end of a day's ploughing. As their home is always situated up hill this results in a furrow that is a potential erosion gully.

The lessee was at all times co-operative even though plainly uncertain as to the effectiveness of the contours. These doubts were accentuated by sceptical countrymen on neighbouring areas. Over the 30th and 31st August, however, two inches of rain fell and the contours carried the large volume of water as planned in the layout. In the four miles of the low base terrace only three breaks occurred. Of these, two were due to high spots in the terrace drain where the grader had been "crabbed" up hill. The third break was due to an aimless plough furrow installed from the top of one terrace to the drain of another as the ploughman was homeward bound. All three breaks were repaired at the time and the faults remedied. The sod contour furrows and main drains slackened down and carried away the water from the watersheds above cultivation, so that the main gully instead of being a roaring torrent as before, was a drain carrying but a modest volume of water from contour outlets.

The soundness of the layout and construction having therefore been plainly demonstrated, the future efficiency of erosion control on the property rests on maintenance of the contours, and the working of the land on the contour. This is the responsibility of the leasee and is a responsibility he appreciates.

KWONG TIY & COMPANY LIMITED

REGISTERED OFFICE: **CUMMING ST., SUVA, FIJI**

P.O. BOX 89

GENERAL MERCHANTS & COPRA EXPORTERS

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PRODUCE (IMPORTS AND EXPORTS) FOR 3 MONTHS ENDING 31ST DECEMBER, 1948.

Imports.	Quantity lb	New Zealand £F		Australian £F		Other Countries £F		Total Value £F	
		Imports.	Exports	Imports	Exports	Imports	Exports	Imports	Exports
Aust. Fresh Fruits	32,767	....	....	958	....	....	....	958	....
N.Z. Fresh Fruits	28,682	775	....	....	....	....	....	775	....
Aust. Fresh Vegetables	131,622	....	....	4,860	....	....	....	4,860	....
N.Z. Fresh Vegetables	6,773	174	....	....	....	....	....	174	....
China Fresh Vegetables	16,726	....	....	....	....	793	....	793	....
Aust. Fresh Onions	240,722	....	....	1,996	....	....	....	1,996	....
N.Z. Fresh Onions	293,325	3,559	....	....	....	....	....	3,559	....
Aust. Fresh Potatoes	73,220	....	....	607	....	....	....	607	....
N.Z. Fresh Potatoes	572,638	5,237	....	....	....	....	....	5,237	....
U.S.A. Fresh Spices	1,060	....	....	....	....	7	....	7	....
Aust. Fresh Spices	4,681	....	....	313	....	....	....	313	....
India Fresh Spices	17,208	....	....	....	....	1,062	....	1,062	....
Zanzibar Fresh Spices	676	....	....	....	....	51	....	51	....
N.Z. Fresh Spices	98	13	....	....	....	....	....	13	....
Sundry Fresh Spices	1,920	....	....	....	....	116	....	116	....
EXPORT									
U.K. Copra (tons)	4,208	....	....	....	....	....	258,104	....	258,104
U.K. Coconut Oil (tons)	3,250	....	....	....	....	....	283,472	....	283,472
N.Z. Bananas	4,339,170	....	32,443	....	....	....	....	....	32,443
Canada Bananas	46,530	....	....	....	....	....	720	....	720
N.Z. Pineapples	330,120	....	3,576	....	....	....	....	....	3,576
N.Z. Mixed Fruits	21,240	....	266	....	....	....	....	....	266
N.Z. Peanuts	196,000	....	10,410	....	....	....	....	....	10,410
Samoa Peanuts	3,330	....	....	....	....	....	110	....	110
N.Z. Green Ginger	30,450	....	508	....	....	....	....	....	508
N.Z. Arrowroot	1,560	....	48	....	....	....	....	....	48
N.Z. Watermelons	2,243	....	337	....	....	....	....	....	337
N.Z. Dalo	9,040	....	51	....	....	....	....	....	51
N.Z. Yams	640	....	5	....	....	....	....	....	5
N.Z. Mangoes	440	....	14	....	....	....	....	....	14
N.Z. Pawpaws	160	....	2	....	....	....	....	....	2
N.Z. Coconuts	14,400	....	108	....	....	....	....	....	108
N.Z. Coconut Meal	316,200	....	1,890	....	....	....	....	....	1,890
N.Z. Rice Bran	50,400	....	280	....	....	....	....	....	280
N.Z. Shelled Peanuts	118,236	....	5,912	....	....	....	....	....	5,912
N.Z. Mixed Vegetables	400	....	7	....	....	....	....	....	7
N.Z. Oranges	60	9,758	1	8,734	....	2,029	542,406	20,521	1
	....	....	55,858	....	....	....	....	....	598,264

The following commodities are not included: Flour, Sharps, Rice and Sugar.

R. A. KABLE,
Produce Inspector.

ECONOMIC BOTANY . . .

LIST OF GRASSES RECORDED IN FIJI: 1860 TO 1948

BY B. E. V. PARHAM

Ammophila arenaria (*L*) *Link*. Europe. Marram grass. Introduced during 1947 for trial on sand dunes in Nadroga-Navosa Province, but not established.

Amphilophis glabra (*Roxb.*) *Stapf*. Tropical Asia. Native blue-grass or Caboni grass. Widespread in dry zone Province of Bua, Labasa 1927, Nadroga-Navosa and elsewhere.

Andropogon pertusus (L) Willd. India. Barbados sourgrass, spreading in the Provinces of Ba and Ra. Stock do not appear to like it.

Arundo donax L. Europe, Asia. "Giant reed". "Gasau ni Vavalagi". Distribution: Naitasiri, Nadroga-Navosa and elsewhere common.

Avena sativa L. Temperate regions. Oats. Jai (H.) Mature plants occasionally seen at Nausori. Rare.

Astrebla triticoides. Wheat-eared Mitchell grass.

Axonopus affinis. Chase. Narrow-leaved Carpet grass. Pasture grass on dairy farms. Tailevu and elsewhere.

Axonopus compressus (Sw.) Beauv. Tropical and sub-tropical. American Carpet grass. Distribution: Very common as pasture and lawn grass especially in wet lowland districts, or in moist situations.

Bambusa nana. Dwarf Bamboo. Common, cultivated and wild.

Bambusa vulgaris. Bitu ni Vavalagi (F.). Very common, especially on upper reaches of main rivers, where it is used for rafts and fencing.

Bambusa siamensis. Cultivated and naturalised. Not common.

Brachiaria distachya A. Camus. India. Thurston grass. A valuable pasture grass in dry zone, common as a roadside weed in wet zone. Very widespread.

Brachiaria mutica Stapf. Tropical America. Para grass. Rank growing stoloniferous, yielding large quantities of fodder, relished by stock. The main pasture grass on alluvial flats in the wet zone, but does not stand over-stocking. A bad weed of cultivation and of all unoccupied land in Naitasiri. Distribution: Very common in wet zone, local in dry zone. Said to have been accidentally introduced.

Cenchrus calyculatus Cav. New Zealand and Polynesia. Taveuni, Wakaya and Macuata. Rare. First recorded 1860.[1]

Cenchrus ciliaris L. Dry Tropics. Buffel grass.

Cenchrus pennisetiformis, Hochst and Stettd. North-East Africa. Distribution: Introduced for trial but not established.[4]

Cenchrus echinatus L. America. Burr grass. "Se bulabula" (F). Distribution: Very common in dry zone and at Levuka and other places near sea beaches. A troublesome weed. The burrs have been noted on the clothing of air passengers landing at Nadi Airport.

Centotheca latifolia, Trin. Tropical Asia to Polynesia. "*Luna*" (F.). Possibly an aboriginal introduction, adapted for dispersal by human agencies. Distribution: very common in shady places up to 3000 feet.

Chloris cynodontoides, Bal. New Caledonia, Fiji. Distribution: Very rare. Sigatoka—1927.

Chloris gayana Kunth. Tropical and South Africa. Rhodes grass. A valuable fodder, under suitable conditions. Trials at Naduruloulou 1933–34 and 1945–48. Distribution: Rare.

Chloris radiata (L) Sw. Central America. Plush grass. A weed of roadsides. Distribution; Common.

Chloris truncata, R. Br. Australia. Australian Finger grass. Distribution: Very rare.

Chloris virgata, Sw. West Indies, South America. Feather Finger grass. Introduced 1907 for trial at Lautoka.

Chrysopogon aciculatus Retz. (*Rhaphis aciculata* Retz.) Trinidad, Tropical Asia. Seed grass, Golden Beard grass. "Kase" (F). A rough turf-forming grass in pastures and lawns: of rapid growth propagated by seeds and runners. Objectionable on account of the needle-like callus. Useful on aerodromes and playing fields. Common also in pastures throughout. Seeds produce irritating sores on head and feet of cats and dogs.

Coix Lachryma Jobi L. Old world Tropics. Job's tears, Adlay, "Sila" (F). An aboriginal introduction—the false fruits are used for beads. Although a useful cereal, has not been used locally as food, although several strains have been introduced. Distribution: very common as a lowland weed of native cultivations and waste land.

Cymbopogon citratus (D.C.) Stapf. India. "Lemon grass". Herva chela (H.) Coboi (F). Yields an oil. Trials at Nasinu 1907.

Cymbopogon refractus (R.Br.) A. Camus. Australia and Polynesia. "Barbed wire" grass, Soap grass. A weed of the dry zone, on open hilly country and "talasiga". Distribution: common in dry zone.

Cymbopogon nardus. (Linn.) Rendle. India. Citronella grass. Leaves contain oil. Introduced for experimental purposes 1907—now widespread in Lautoka and Nadi districts, Province of Ba.

Cynodon dactylon (Linn.) Persia, West Indies. Couch grass, Bermuda grass, Kabuta (F). A good lawn grass in dry zone or on well-drained soil. A weed of cultivations and of roadsides. Useful for grassing contour slopes and banks. Distribution: very common.

Cynosurus cristatus L. Europe. Crested Dog's Tail. Introduced for trial but not established.

Cyrtococcum oxyphyllum, Stapf. Indo-Malaya to Polynesia. Probably an aboriginal introduction. Distribution: Common.

Dactylis glomerata Linn. Temperate Old World. Cock's foot grass, orchard grass. a valuable pasture grass of cool climates introduced and reported to be doing well at Nadarivatu in 1921 [15]: In trials in 1934 at Naduruloulou it failed to persist after flowering. Distribution; very rare.

Dactyloctenium aegyptiacum Willd. Africa, Asia. A weed of open ground and waste places. Distribution: very rare.

Dicanthium caricosum, A. Camus. Tropical Asia. "Antigua Hay grass", also known as Nadi blue grass. Introduced 1907—one of the most important pasture grasses in dry zone. [10]

Dicanthium nodosum Willen. Tropical Asia. Known as Blue grass and often confused with *D. caricosum,* Nawai or Nadi blue grass. The species occurs in the wet zone as a roadside weed and has been established in pastures in the dry zone areas in Ba Province. [10]

Dicanthium annulatum, Stapf. Old World. Weed of ditches, roadsides and open ground. Distribution: fairly common in vicinity of Suva.

Digitaria chinensis, Hornem. India, Malaya. First recorded by Rendle [2] as a recent introduction. Now common in many localities up to 600 feet as a weed in open waste places.

Digitaria longiflora Retz. Persia, Tropical Africa and Asia. A creeping perennial grass forming excellent turf. Distribution: common throughout the Colony.

Digitaria melangiana. Woolly Finger grass. Established for a number of years at Yaqara in Ra province. A promising grass under trial at Naduruloulou since 1945.

Digitaria pruriens Buese. India, Malaya. An early introduction in waste places and open fields. Distribution: very common.

Digitaria sanguinalis (Linn.) Sw. Tropics. Large crab-grass, recent introduction. A common weed in cultivated soil and waste places—said to be an excellent fodder grass. Distribution: very common.

Echinochloa colona (Linn.) Link. Tropics and sub-tropics. Jungle-rice. A common weed of roadsides and waste land; an inferior cereal in India. Abundant in rainy season, dies out in the dry. Distribution: very common. First recorded in 1907 (L. Gibbs).

Echinochloa crusgalli (L) Beauv. Europe and America. Barnyard grass. A weed of rice fields and swampy places. Distribution: very common.

Echinochloa crusgalli var. *frumentacea*, Link. Old World. Japanese Barnyard Millet—weed of rice fields, inferior millet and forage. Distribution: very common.

Echinochloa stagnina Retz. Beauv. Reported by Greenwood in 1944 from Navua.[8]

Eleusine coracana, Gaertn. Tropical Africa and Asia. Finger Millet. "Mandua" (H.) Cultivated. P.R. No. 2801.

Eleusine indica (Linn.) Gaertn. Old World Tropics. Goose grass, Wiregrass. Kavoronaisivi (F). An early introduction—when young eaten to a small extent by stock; a weed of cultivation and roadsides. Distribution: very common.

Eragrostis amabilis (Linn.) Wight. India. Lovegrass—open ground and roadsides, Naitasiri. Distribution: rare.

Eragrostis pilosa, Beauv. Southern Europe. Distribution: Local.

Eragrostis cilianensis (All.) Link. Europe. Stink grass. Weed of roadsides. Recent introduction (1942), Queen's Road, Rewa Province. Distribution: Common in locality.

Eragrostis Tef Trotter. Abyssinia. "Tef", introduced 1907 but failed to become established.[4]

Eragrostis unioloides (Retz) Nees. Collected at Cuvu in Nadroga-Navosa (1944) by Greenwood.[8] Also at Navua.

Erianthus maximus Brong. Polynesia. "Vico" (F).

Eriochloa procera (Retz) C. E. Hubbard. At Lautoka and Nadi, Province of Ba. Greenwood 1944.[8]

Eriochloa ramosa O. Ktze. Tropical Asia and Africa. In moist places—edges of gutters at sides of streets—Suva.

Eriochloa polystachya H.B.K. (*Eriochloa subglabra* (Nash) Hitch.). West Indies. Carib grass. Introduced 1920—showed considerable promise. Similar to para grass. Has disappeared from cultivation. Sampson 1935.[4] Distribution: Rare.

Euchlaena mexicana Schrad. Central America. Teosinthe. Introduced 1909 and distributed as a fodder crop 1920. Tall annual resembling maize, cultivated as a fodder. Distribution: Rare, cultivated.

Gastridium ventricosum (Gouan) Schinz. Europe. Nit grass. A common weed on Pacific Coast of America—of no economic value. Distribution: Common.

Gigantochloa aspera Building bamboo.

Gynerium sagitatum (Aubl.) Beauv. Tropical America. "Gasau ni Vavalagi" (F). Wild cane. River banks and low grown—Naitasiri, etc. Distribution: Common.

Heteropogon contortus (Linn.) Beauv. Tropical Africa and India. Spear grass. Tanglehead. Lautoka, Nadi, Ra, Sigatoka, also Macuata Province. Dry zone, weed of open places. Distribution: Widespread and favouring open grasslands in many areas. Palatable when young but easily pulled up by cattle owing to shallow root system.

Hordeum vulgare L. India "Jau" (H). Barley. Annual. Introduced 1920.

Hyparrhenia rufa (Nees) Stapf. "Jaragua" introduced by R. B. Howard in 1938.[7]

Imperata cylindrica (L) Beauv. Old World. "Gi" (F). A bad weed of cultivation. Ovalau, Macuata, Vitilevu. An early introduction. Distribution: Common.

Ischaemum aristatum, Linn. Tropical Asia. Reported at Labasa about 1919. Formerly regarded as a weed of roadsides and open hillsides. Also at Naduruloulou—1934. Distribution: Common in locality. Useful pasture grass. "Batiki Blue grass."

Ischaemum timorense Kunth. "Waidoi grass" introduced accidentally about 1914 and established at Waidoi in Rewa Province. Now in pastures at Vunidawa and Fanuakula, Naitasiri and elsewhere. Not apparently palatable to stock.

Ischaemum rugosum, Salisb. India. Muraina grass. A serious pest of rice fields everywhere. Recorded first 1936 "by Turbet."[5] Distribution: Very common throughout all the main islands: declared a noxious weed in 1946.

Lolium perenne, Linn. Europe. Perennial grass. Trials at Naduruloulou 1934. Not established.

Lolium multiflorum, Lan. Africa. Italian rye grass. Introduced 1933 but failed to persist in trial plots at Navuso.

Melinis minutaeflora Beauv. South America, tropical and sub-tropical Africa. Molasses grass. Introduced and established at Central Agricultural Station 1934 and again in 1945. Distributed to Ra and Tailevu—palatable to stock and grows well.[9]

Miscanthus japonicus Anders. Polynesia, Fiji. "Gasau" (F). The reed grass, an indigenous species widespread in all parts of the Colony.

Oplismenus compositus Beauv. Pantropic: recorded by Greenwood from Mt. Evans, Vitilevu, in 1944.

Oplismenus hirtellus Beauv. Tropical and South Africa, Tropical America and Polynesia. Recorded by Milne (1860) from waste ground on Nairai. Distribution: Rare.

Oryza sativa, Linn. India. Rice. Dhan (H). Two races introduced—

(*a*) Hill or Mountain Rice—
Vars.—

Baramasia 1915.
Sonacalif
Motka
Borneo E III
Ramay

1933 B.G. Vars. B.G. 75, 79—
Ramcajara
Bluestick
Demarara
Creole

1937 to 1941—
Sereya Patna, Rewa Patna
Motmuria

1940—
New Guinea.

(*b*) Swamp or irrigated Rice—
Patna 1917.

Panicum decompositum, R.Br. Australia and New Caledonia. Reported on Wakaya by Milne C. 1860—at Sigatoka on sides of cutting 1927[8] Distribution: Rare.

Panicum maximum Jacq. Tropical Africa. Guinea grass. Grown at Nasinu 1907, now widely distributed throughout—especially in dry zone e.g. Province of Bua and Macuata. Said to have been originally exported from Guinea coast to Jamaica for bird seed. It became naturalized and its value as a fodder grass was soon discovered. In Fiji regarded as a weed in cane fields but as valuable fodder in dry zone. Distribution: Very common in Procinces of Ra, Ba and Nadroga-Navosa—also in Macuata and Bua.

Panicum reptans L. (*Urochloa reptans* Stapf.) Annual grass considered a good fodder in India. Reported locally at Labasa and Lautoka, 1927. Distribution: Rare.

Panicum repens, L. Tropical Old world. Perennial from extensively creeping rhizhomes. Distribution: Common.

Paspalum conjugatum Berg. Tropics. "Ti" grass, Sour or yellow grass. A weed in cultivated and waste land; has spread widely in Fiji and occupies large areas of river flat and lowland hills—not considered a good fodder although common in pasture areas and eaten by stock when young. Distribution: Very common.

Paspalum dilatatum Poir. South America. Dallis grass—under trial 1907.[8] A valuable pasture grass, much cultivated in many parts of the world. Well established and now spreading in many localities. Distribution: Common in locality. Is occasionally infected by Ergot.

Paspalum distichum L. Central America and Chile. Swamp couch or Knot grass. Widely creeping perennial in wet places—Suva and Naduruloulou. Probably of recent introduction. Distribution: Rare.

Paspalum galmarra Bailey (Paspalum paniculatum L.) Queensland. Russell River grass, introduced by R. B. Howard,[6] and well established in Naitasiri and Tailevu. Formerly described as an excellent fodder grass, this plant is not relished by stock at any stage of growth. Distribution: Common.

Paspalum orbiculare Forst. Tropical Asia. Ditch Millet. "Co duru levu" (F). A perennial grass probably an aboriginal introduction. Distribution: Very common throughout in open country.

Paspalum notatum Flugge. Central America. Bahia grass, introduced in 1938 by R. B. Howard but failed to become established.[9]

Paspalum scrobiculatum L. Introduced in 1947 from Queensland and established at Naduruloulou—under trial.

Paspalum Urvillei Steud. Brazil. Vasey grass—established in several places—Nadarivatu and Waimaro, Tailevu, spreading A tall grass of robust growth.

Paspalum vaginatum Swartz. Tropics. "Kabuta". Perennial forming large patches behind mangroves along banks of creeks and waterways. Probably indigenous Distribution: Common.

Pennisetum clandestinum Hochest. East Africa. Kikuyu grass. Introduced 1920 and distributed 1921. A valuable creeping pasture grass where conditions suit its growth. Reported to have become established locally. Distribution: Rare.

Pennisetum pedicellatum. Kyasuwa grass —introduced 1945 from Trinidad and two strains viz. brown and yellow seeded, under trial at Nadururloulou.[13]

Pennisetum purpurum Schum. Tropical Africa. Elephant grass or Napier's fodder. Reported as established 1925 at Navuso. Still growing at Davuilevu, Suva, but has not spread as was anticipated. Distribution: Now well established in many areas. An improved strain introduced from Imperial College of Tropical Agriculture, Trinidad, in 1945 and established.[13]

Pennisetum polystachyum Sch. Tropics. Mission grass. Imported from Gainesville, U.S.A., in 1920 and issued 1920. Distribution: Common. In Ba Province has spread widely to include other species.

Pennisetum setaceum Chois. (*Pennisetum Ruppeli* Steud.) Africa. Fountain grass—ornamental erect perennial. Distribution: Cultivated, common—much relished by stock.

Pennisetum typhoides Stapf and Hubbard. Tropical Africa and Asia. A common dry land cereal in the tropics and subtropics, reported as successfully introduced.[4]

Phalaris tuberosa L. Temperate. Introduced but not established.

Pennisetum Ruppeli Steud. Africa. Fountain grass. Perennial ornamental grass very palatable to stock.

Pollinia glabrata Trinidad. Indigenous; rare on hills at 2000 feet.

Rhynchelythrum dregeanum Nees. Tropical and South Africa. Holmes grass. Natal Red-top grass—cultivated in many parts of the world as a fodder. Introduced early and now widely spread especially in Bua and Macuata—also in Rewa and Naitasiri, Ba and Nadroga-Navosa. Distribution: Common.

Saccharum officinarum L. Tropics. Sugarcane. "Dovu" (F), "Ganna" (H). Widely cultivated. Many varieties early introduced e.g. "Nanai" Noblecanes as Badila, Malabar. Argus widely cultivated. Distribution: Very common, cultivated.

Saccharum edule L. Asia. "Duruka" (F). Several varieties cultivated. Occurs in a wild state in many districts.

Setaria barbata (Lann) Kunth. Tropical Asia. "Mary grass". Branching annual introduction (1937). Distribution: Local.

Setaria lutescens (Weigel) F. 7. Hubb (*Setaria glauca*). Europe. Yellow bristle grass. Erect annual, a common weed in cultivated soil and waste places. Distribution: Common.

Setaria palmifolia (Willd.) Stapf. India. "Palm grass". Perennial 4 or 5 feet high. Cultivated and escaped from cultivation—Suva. Distribution: Rare.

Setaria verticellata (Linn.) Beauv. Europe. Burr bristle-grass. Annual weed of field and waste places. Distribution: Common.

Sorghum bicolor Moench. var. *techniens* Stapf. Asia. Broom corn. Cultivated with good results Sigatoka and Nadururloulou 1938. Distribution: Cultivated, rare.

Sorghum halepense L. Tropical Asia. Johnson grass. A robust perennial weed in fields and waste places. Introduced in 1905 as a fodder but root-habit made it difficult to eradicate and it rapidly became a pest. Plant may be poisonous when young or stunted by drought. Proclaimed a noxious weed in 1947.[14] Distribution: Very common in dry zone.

Sorghum sudanense Stapf. Sudan grass—introduced and seed distributed 1920, but has not become established.

Sorghum vulgare Pers. Guinea Corn. Jowar (H.) Numerous varieties introduced 1930, 21—Sholla, Sumac, Dwarf Kaffir, Honey, Dwarf Milo, Feterita, Red Amber. Commonly cultivated and occasionally as an escape from cultivation. Distribution: Cultivated, common.

Sorghum verticiflorum var. Kenya, East Africa. "Kavirondo Sorghum", introduced 1945 from Imperial College of Tropical Agriculture, Trinidad, established as a fodder plant at Naduruloulou and widely distributed.[12]

Sporobolus diander (Retz.) Beauv. Tropical Asia. Indian dropseed. Tufted perennial—roadside weed—Suva. 1927). Distribution: Common in locality.

Sporobolus indicus (Linn.) R.Br. Tropical America. Tufted perennial reported at Labasa 1927 in clumps in dry places by side of roads. Distribution: Rare.

Stenotaphrum secundatum (Waltz) Kuntze. Tropical America and Africa. St. Augustine grass. Perennial—an excellent pasture and lawn grass but a bad weed in plantations. Distribution: Common in dry zone: Nadarivatu, and Ra.

Themeda quadrivalvis (L) Kuntze. India. Kangaroo grass. Annual up to 5 feet high. Reported at Lautoka on roadsides 1927 as a recent introduction; has now spread widely in Ba Province.

Tripsacum dactyloides L. America. Buffalo grass—reported at Nasinu 1907.

Tripsacum laxum Nash. Mexico and Central America. Guatemala grass. Introduced in 1945 from Trinidad: has been established and distributed to Ba, Tailevu, Rewa and Nadroga-Navosa Provinces. An excellent fodder grass.[11]

Vetiveria zizanoides Nash. India. Vetiver grass. "Khas-khas" or "Garara" (H). Grown experimentally 1907—now widely spread and weed of roadsides, etc. Used to bind rice-bunds. Vetiver oil is obtained from the roots. Leaves make good thatch. Distribution: Common, especially in dry zone—Ba and Nadroga-Navosa Provinces.

Zea mays L. Tropical and sub-tropical America. Maize—"Maka" (H). "Sila ni Vavalagi" (F). Early introduction recorded by Seemann 1860 (1) who says only one variety cultivated by Europeans, natives had not taken to growing it. Many varieties cultivated—var. *indentata* Bailey. North America. "Dent Corn".

var. *indurata*, Bailey. C. & N. America "Fruit Corn"

var. *praecox*, Bonaf. North America "Pop Corn"

var. *rugosa*, Bonaf. Mexico, "Sweet Corn".

Distribution: Cultivated, common.

REFERENCES.

1 1865–73 Seemann B. "Flora vitiensis"—London.

2 1909 Gibbs, L. A contribution to the Montane Flora of Fiji—*Jour. Linn. Soc. Bot.* 39: 130–212.

3 1927 Summerhayes, V. S. and Hubbard, C. E. "The Grasses of the Fiji Islands" Kew. Bulletin No. 1, 18.

4 1936 Sampson, H. C. "Cultivated Crop Plants of the British Empire & Anglo-Egyptian Sudan"—Kew Bull. Supp. Set XII Lond.

5 1937 Turbet, C. General Notes—*Agric. Jour. Fiji*, Vol. 8, No. 4, 46.

6 1939 Parham, B. E. V. "List of Plants introduced to Fiji" *Agric. Jour. Fiji*, Vol. 10 No. 4, 112.

7 1941 Parham, B. E. V. "Alien Flora of Fiji", read before the Fiji Soc. of Science and Industry, 14th July (publication pending).

8 1943 Greenwood, W. "The Adventive and Weed Flora of the Leeward coasts of Fiji"—Proc. Linn. Soc. Lond. Session 154.

9 1944 Parham, B. E. V. "Plant Introductions 1933–43" *Agric. Jour. Fiji*, Vol. 15 No. 4, 94.

10 1945 Parham, B. E. V. "The Blue Grasses of Fiji"—ib. Vol. 16, No. 4, 104.

11 1946 Parham, B. E. V. "Fodder & Pasture Trials", ib. Vol. 17, No. 1, 20.

12 1946 Parham, B. E. V. "New Fodder Crops for Fiji" (Kavirondo Sorghum)—ib. Vol. 17 No. 4, 113.

13 1947 Parham, B. E. V. "Recent Plant Introductions", ib. Vol. 18, No. 2, 77.

14 1947 Mercer, A. D. "Noxious Weeds (Amendment) Regulations 1947" ib. Vol. 18, No. 3, 76.

15 1921, McKeown, G. M. "Grasses for Fiji," Agric. Circ. Fiji, Vol. 2, No. 4, 75.

LIST OF INTRODUCED LEGUMINOUS PLANTS RECORDED IN FIJI

BY B. E. V. PARHAM

Leguminosae:

Abrus precatorius L. East Asia. Black-eyed Susan, liana common in coastal scrub.

Acacia farnesiana Willd. Tropical America. Ellington Curse, an early introduction, proclaimed a noxious weed in 1925 and 1946. Common Ra and Ba and Tailevu.

Acuan virgatum (L.) Medic. Tropical America. "Desmanthus" This fodder shrub has been established for several years (P.R. 1240), makes excellent growth and seeds profusely. Cut as fodder for cattle and pigs, also grazed. Distributed to Tailevu Cakaudrove, Nadroga-Navosa and Ra.

Adenanthera pavonica L. India. Red Sandalwood or Red Bead Tree. Naturalized in several parts of Viti Levu.

Aeschynomene indica L. East Indies. "Sensitive Joint Vetch". Common weed of ricefields and ditches. Ba, Ra and Bua. On trial as fodder crop, Naduruloulou 1945–48.

Albizzia falcata (Linn.) Backer. White bark Rain Tree. Introduced 1935—successfully established on various station, Waimaro, etc.

A. lebbek (L.) Benth. Pan-tropic. "Lebbek" or "Siris". Early introduction about 1907—naturalized and spreading in Naitasiri, Ra and Ba. Common.

A. procera (Roxb.) Benth. Tropical Asia. Silver Bark Rain Tree. Naturalized and spreading at Lautoka and Labasa. Common.

A. saponaria L. Asia. Tree naturalized and spreading in Tailevu.

Alysicarpus vaginalis DC. Ind. Or. "One-leaved Clover". Widespread in grasslands and waste places, especially in dry zone; but not important as fodder.

Andira inermis H. B. & K. Trop. America. Cabbage Bark Tree.

Arachis hypogaea L. Brazil. Peanut or Groundnut. Common, cultivated.

Atylosia scarabaeoides Benth. "Peanut grass"—Nadroga-Navosa, Ba and Ra.

Bauhinia alba. Cultivated ornamental shrub.

B. galpini N.E. Bo. South Africa. Cultivated ornamental shrub—rare.

B. monandra Kurz. Commonly cultivated and spreading in vicinity of old settlements—Nadroga-Navosa.

B. purpurea L. Indian Orient. Butterfly Tree. Common cultivated and naturalized small tree.

B. tomentosa L. Tropical Africa. Yellow-flowered Bauhinia, rare.

Brownea grandiceps Jacq. S. America. Rose of Venezuela. Naturalized ornamental tree.

Caesalpinia coriaria Willd. Tropical America. American Sumach. Rare cultivated.

Caesalpinia pulcherrima Sw. Dry Tropics. Peacock Flower or Pride of Barbados—common cultivated shrub.

C. sappan. Sappan Wood. Cultivated shrub, rare.

Cajanus cajan (Linn.) Millsp. Tropical Africa. "Dhal" (H). Pigeon Pea. Widely grown in dry districts for pulse crop, also used as fodder. Improved var. (P.R. 1339) introduced 1945 from I.C.T.A., Trinidad—established and distributed.

Calopogonium muconoides Desv.

Canavalia ensiformis DC. Sword or Jack Bean. Cultivated liane. Also improved bush type introduced 1945.

C. obtusifolia (Lam.) DC., *C. rosea* DC., *C. sericea* A. Gray. Tropics. Aboriginal weeds, sea coast, helping to bind sand dunes at Cuvu, Nadroga-Nvosa.

Cassia alata L. = *Herpetica alata* q.v.

C. brewsterii F.V.M. Queensland. Rare cultivated introduced 1941.

C. fistula L. Tropical Asia. Golden Shower. Established and common cultivated tree.

C. florida = *siamea* q.v.

C. grandis L. Panama. Pink Shower. Common.

C. hirsuta L. Trop. America. Hairy Cassia—King's Road, shrub common in dry districts.

C. javanica L. Malaya. Rare ornamental tree introduced 1910.

C. laevigata Willd. Tropics. Found occasionally in wild state.

C. marginata Roxb. India and Ceylon. Rare ornamental tree. Nasinu.

C. mimosoides L. (= *C. leschenaultiana* DC.) Tropics "Japanese Tea". Weed established at Savusavu, in Cakaudrove, Ba and Nadi. Grown experimentally as fodder plant: not relished by stock.

C. multijuga Risb. Trop. C. America. Introduced 1947 and established.

C. nodosa Ham. ex Roxb. Ind. Orient. Pink Shower. Common ornamental tree. Seed rarely set in dry zone.

C. occidentalis L. Trop. America. "Kau moce". Negro Coffee. Common weed in many districts—in cultivated lands, pastures and coconut plantations.

C. siamea Lam. Ind. Orient, Malaya. Common ornamental cultivated tree.

C. tora L. Tropics. "Kau moce". Common weed—throughout.

Castanospermum australe Cunn. Austalia Moreton Bay Chestnut. Rare.

Centrosema pubescens Benth. Trop. America. Introduced 1936, naturalized and spreading—Naitasiri, Tailevu and Ra. Excellent fodder plant.

Ceretonia siliqua L. S. Europe. Algaroba —Carob Bean. Bua, Ra and Tova Is., established but not common.

Chamaecrista leschenaultiana (DC) Degener = *Cassia mimosoides* q.v.

Cicer arietinum L. S. Europe and Aisa. Chick Pea. Cultivated, rare.

Clitoria ternatea L. Tropics. First mentioned by St. Johnston—naturalized and local in dry zone—useful fodder.

Colvillea racemosa Bojer. Madagascar. Introduced ornamental cultivated tree.

Crotolaria alata Ham. ex Roxb. Trop. Asia.

C. anagyroides H.B. & K. Venezuela, introduced 1944 and established as cover crop.

C. juncea L. Trop. Asia. Sunn Hemp. Introduced as a green cover crop and fibre plant, grown experimentally but not established.

C. quinquefolia L. First recorded by Seemann in 1860—not common but seen on the island of Ono, Province of Kadavu, in 1944.

C. usaramoensis E. G. Baker. East Tropical Africa.

C. sericea Retz. Tropical Asia.

C. mucronata Desv. (*C. saltiana* Andrews) E. Asia. "Common rattlepod". Widely distributed throughout the Colony, especially in dry areas.

C. assamica. Small shrub occasionally cultivated.

C. retusa L. Tropics.

Cyamopsis psoraloides DC. Ind. Or. Cluster Bean. Successfully introduced.

Cynometra cauliflora L. Ind. Or. Introduced cultivated tree. Nasinu No.

Cytisus proliferus L. Teneriffe. Tree Lucerne. Introduced but failed to become established.

Dalbergia lanceolaria. Rare tree. Nasinu.

Delonix regia Rafin. Madagascar. Flamboyante. Widespread culitvated ornamental tree.

Derris dalbergioides Baker. Botanic Gardens, Suva. Rare ornamental tree.

D. elliptica Benth. Malaya. Commonly grown about native villages. Fish poison. Var. Changi No. III introduced 1936; Amani strain 1938.

D. malaccensis Prain. "Duvu Niu kini" (F.) Commonly grown in all islands and used as a fish poison.

D. trifoliata Lour. Pan-tropic. "Wa duva" (F.) Common indigenous liane confined to coastal situations.

Desmodium canum (Gmel.) Schinz & Thelling. Trop. America. "Kaimi Spanish Clover", local, rare. Introduced 1947 (P.R. 1377).

D. discolor Vog. Brazil. "Giant beggar weed", introduced 1944 (P.R. 1245) and established in trial plots where it tends to spread from seed. A large perennial species, not very palatable to cattle.

D. tortuosum (Sw.) DC. West Indies. "Florida beggar weed", established at Naduruloulou 1932 and persisting in locality for many years. Not seen elsewhere.

D. triflorum (L.) DC. Tropics. "Three flowered *Desmodium*" a creeping plant, forming a dense mat common in lowland

grass lawns and pastures in wet zone. Palatable but too small to provide much forage.

D. polycarpum DC. Old World Tropics. Introduced 1925 at Navua and Tavua.

D. multiflorum. "Solomon Islands Clover", reported as established and growing well in 1925.

D. heterophyllum DC. Trop. Asia. "Trefoil, Tropical Clover". Common in pastures and grasslands—providing excellent fodder—springing up luxuriantly on sites of fires. Combines well with *Axonopus* and *Paspalum* pastures.

D. unciniatum(Jacq.) DC. (Haleakula strain). Trop. America. "Spanish clover". Seeds introduced from Hawaii (P.R. No. 1378) in 1947.

D. supinum DC.

Dipteryx odorata Benth. Tonka Bean: introduced 1945 (P.R. 1251), rare, Naduruloulou.

Ditremeca occidentalis (L.) Britton & Rose = *Cassia occidentalis* L. q.v.

Dolichos biflorus L. Old World Tropics. Horse grass, successfully introduced.

D. hosei Craib. Malaya. Cover crop reported as successfully introduced.

D. lablab L. India. Early introduction.

Erythrina indica Lam. Ind. Or. "Drala" (F.) Early introduction. Large tree with ornamental flowers.

E. lithosperma Blume. Burma.

E. corallodendron L. W. Indies. "Coral tree", not common, cultivated.

Gliricidia sepium (Jacp.) Steud. Central America. "Madre de Cacao", introduced 1932, established—propagated by cuttings, sets seed in dry zone only.

Glycine max (Linn.) Merr. N.E. India. Soy Bean. Cultivated, not common. Many varieties under trial 1926–1947.

Haematoxylon campechianum L. Central America and W. Indies. Logwood. Successfully introduced and established at Labasa and Suva.

Herpetica alata Tropics. "Candelabra tree", ornamental shrub, now well established throughout the Colony. Seeds only in dry districts.

Indigofera suffruticosa Millsp. S. America. Widespread weed in dry zone.

I. endecaphylla Jacq. Tropical Africa. "Creeping indigo".

Kerstingiella geocarpa Harms W. Trop. Africa. Under trial. (Sampson, p. 100).

Lablab vulgaris Aboriginal weed.

Lathyrus odoratus L. Sweet Pea. Ornamental cultivated at Nadarivatu, rarely successfully grown at low elevations.

Lens esculenta Moench. Orient. Lentil.

Lespedeza sericea (Thunb.) Miq. (C.P.I. 3770) N. Asia. "Bush clover", P.R. No. 1348; introduced in November 1946 and under trial at Naduruloulou. Seeded and persisting.

Leucaena glauca (Linn.) Benth. W. Indies and Trop. America. "Vaivai" (F.) Widespread in Viti Levu, [Important browse plant in Ba, Ra and Nadroga-Navosa.] and Vanua Levu—especially in dry zone.

L. Forsteri. Not common. Kadavu, Tailevu, Ra.

Lotus major Sm. (= *L. uliginosus* Schk.) [A 150] N. Europe. "Bird's Foot trefoil", introduced (P.R. No. 1365) in 1946—and grown at Naduruloulou—but did not persist.

Lourea vespertilionis Deav. Tropics. "Bat-leaved Bean", Nanukuloa, Ra.

Lysidice rhodostegia S. China. Nasinu No. 132. Ornamental tree, very rare.

Medicago glutinosa Russia. "Grazing lucerne", introduced 1947. (P.R. 1353).

M. sativa L. Europe, W. Asia. Lucerne of Alfalfa. Cultivated fodder, rare. (P.R. 1532), established at Navai, altitude 2,700 ft. Province of Ba.

Mimosa pudica L. Brazil. Aboriginal weed. Widespread common.

M. invisa Mart. Brazil. First noted Tailevu 1936—declared a noxious weed 1945.

Mucuna aterrima Holland. E. Trop. Africa. Mauritius Bean. widely grown as a green manure crop—also established in Ra Province.

Myroxylon pereirae Balsam of Peru. Nasinu No. 178, No. 3. Rare.

Omosia dasycarpa. Rare ornamental tree. Nasinu.

Pachyrrhizus tuberosus Spreng. Trop. Asia. Yam Bean. Cultivated, not common.

Parkia africana. Large timber tree, in plantations Nasinu, Waimaro, Korovou, Tailevu.

Peltophorum ferrugineum Benth. (*P. inerme* Naves) Ceylon and Malaya. "Yel-

low Poinciana". Large ornamental and timber tree, naturalized and widely planted.

Phaseolus aureus Roxb. (*P. radiatus* L.) India and Africa. "Green Gram". Spreading on roadsides.

P. calcaratus Roxb. (*Vigna luteola* Merr.) India, Malaya. "Rice bean".

P. lunatus Linn. Trop. America. "Madagascar or Lima bean".

P. aconitifolius Jacq. India. Moth Bean. Successfully introduced.

P. lathyroides L. (= *P. semi-erectus* L.) Trop. America. "Wild pea bean", widespread in dry areas, occasional on roadsides in wet areas. Although eaten by cattle, feeding trials at Naduruloulou indicate that it is not relished. Growth sparse and productivity of fodder poor. Common in dry pasture.

P. mungo Linn. Tropics of Asia. "Black gram" or "Woolly Pyrol".

P. adenanthus C. F. Mey. Recorded by Greenwood occurring in dry areas.

P. vulgaris Linn. American subtropical. French or Dwarf Bean grown from seeds imported annually.

Pisum sativum Linn. W. Asia. "Garden pea". Seasonally cultivated.

Pithecellobium dulce (Roxb.) Benth. C. America. "Madras thorn" locally called "Monkey pod". Established and spreading at Penang, Ra.

Pongamia glabra Vent. India and Ceylon. Indian beech, generally regarded as indigenous. Common coastal tree.

Prosopis chilensis (Mol.) Stuntz. South and Central America. "Mesquite" introduced 1918 by R. B. Howard. A few trees established.

Psophocarpus tetragonolobus DC. Tropics. Goa bean, early introduction, cultivated widely.

Pueraria hirsuta Scheid. (*P. thunbergiana* Benth.) China and Japan. Kudzu vine or "Wa yaka" (F.) Widespread throughout the Colony, probably an aboriginal introduction. Abundant in dry hilly country amongst reed grass especially in Macuata, Nadroga-Navosa and Ba provinces. Roots eaten by Fijians as a vegetable—foliage and stems much relished by stock. In cultivation not so satisfactory as the next species. New introductions from Australia in 1946 have been established.

P. phaseoloides Benth. (*P. javanica* Benth.) Ind. Orient and Malaya. Tropical Kudzu. Introduced 1943 by R. B. Howard and established at Naduruloulou—later introductions from Trinidad 1945. Distributed widely as a valuable fodder plant.

Samanea saman (Jacq.) Merr. Central America. "Rain tree". Shade tree. Pods eaten by cattle. Common in tree communities at Ra.

Sesbania bispinosa (Jacq.) Farwett & Rendle. Trop. Africa and Asia. Widespread in rice fields, drains and damp places, Ba and Ra Provinces and Bua Provinces in Vanua Levu. On trial as a fodder at Naduruloulou 1945–1948.

Sesbania grandiflora Pers. (*Agati grandiflora* Deav.) Indian Oreint and Malaya. "Agathi" (H.). Established and grown as an ornamental—flowers used as a vegetable.

Stylosanthes guianensis (Aubl.) Sw. Trop. South America. "Stylo" or "Pencil Flower"—introduced 1943 (P.R. No. 1307).

S. guianensis (Aubl.) Sw. var. *subviscosus* Sw. Brazil. "Creeping Stylo"—well established in type—pastures in Ra forming a short turf which is closely grazed by stock—appears to be drought resistant in this locality.

Tamarindus indica Linn. Trop. African and India. "Tamarind". "Imli" (H.). An early introduction and now well established.

Tephrosia candida DC. Indian Orient, and Malaya. Widespread in dry areas but not common.

Trifolium arvense L. Eurasia. "Harefoot trefoil". Introduced 1946 (P.R. 1364).

T. alexandrinum Linn. Syria and Egypt. Berseem Clover. Two strains introduced from Palestine: Berseem Fahli (P.R. 1373) and Berseem Hesqawi (P.R. 1374) January 1947 and under trial.

T. pratense Linn. Europe and Asia. Red Clover. Montgomery Red Clover Aa 567 introduced 1946 (P.R. 1370). Broad Red Clover Aa 595 introduced 1946 (P.R. 1371). See also Surridge and Parham.

T. repens L. Europe, Asia and Africa. "White Clover". Several introductions; Ordinary White Clover AC 2556 (P.R. 1368) and Pedigree White Clover AC 2549 (P. R. 1369) introduced 1946.

T. procumbens L. Europe. "Hop trefoil"—introduced 1946 (P.R. 1372).

T. subterraneum L. Mediterranean. "Subterranean clover"— Tallarook subterranean clover AK 165 introduced 1946 (P.R. 1368) V. H. Barker subterranean clover AK 164 introduced 1946 (P.R. 1367).

Trigonella foenum-graecum Linn. Europe and Orient. "Fenugreek". "Methi" (H.)—widely grown as a condiment and vegetable.

Uraria lagopoides DC. Tropical Asia. "Lakanakase" (F.) "Dog's Tail Bean"—an early introduction recorded by Seemann (1) widespread in sandy coastal areas also on dry ridge grasslands, in Nadroga-Navosa, Ba, Ra and Macuata.

Vicia Faba Linn. N. Africa; S.W. Asia. "Broad or Windsor Bean". Grown as a garden crop—beans only at higher elevations, e.g. Nadarivatu (2,700 feet.).

Vigna luteola (Jacq.) Benth. Tropics and sub-tropics. Common in reed grassland and amongst coconuts.

Vigna marina (Burm.) Merr. Old World Tropics. Common coastal plant—used as a fodder in Rotuma and other islands.

Vigna unguiculata (Linn.) Walp. Tropical Africa. "Cowpea". Widely grown as a vegetable and green manure or cover crop—also used as a fodder.

V. sesquipedalis (Linn.) Fruw. "Yard long bean"—grown widely as a vegetable crop.

Voandzeia subterranea Thou. Tropical Africa. "Bambara groundnut"—introduced and grown experimentally but not yet established. The pods mature below the ground in a manner similar to the groundnut.

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PLANT INTRODUCTIONS—1949

Recently Mr. J. W. Gregg of Kotoa, Kauai, Hawaii, who is a keen horticulturist, presented the following seeds and plants for propagation in Fiji:

P.R. 1380 Seeds of *Cassia multijuga* (Timor shower).

P.R. 657 Seeds of *Heliconia* (pendant flowers).

P.R. 1382 Seeds of *Cassia fistula* (Indian Laburnum).

Twelve budded named varieties of *Hibiscus* plants as follows:—

P.R. 2234 (Red and Gold) Single petals with yellow stripe.

P.R. 2235 (Kaliki Kai) Single petals deep yellow.

P.R. 2236 (7th Ave. Cream) Single petals cream.

P.R. 2237 (Wadsworth) Single petals light orange with pink centre.

P.R. 2238 (American Beauty) Single petals deep pink.

P.R. 2239 (Takamatsu) Single petals red.

P.R. 2240 (Kalakaua) Double deep maroon.

P.R. 2241 (Dillingham) Semi double: petals orange with pink centre.

P.R. 2242 (Lemon cup and saucer) Semi double: petals lemon yellow.

P.R. 2243 (Pele) Semi double: petals orange red.

P.R. 2244 (Honolulu Beauty) Semi double: petals light orange.

P.R. 2245 (Double White) Semi double: petals white.

The above donations represent a valuable addition to the collections in the Colony and it is hoped to be able to propagate from these for local amenity planting. —B.E.V.P.

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ENTOMOLOGY . . .

PREMATURE NUTFALL OF COCONUTS IN THE BRITISH SOLOMON ISLANDS PROTECTORATE

BY B. A. O'CONNOR

[*During* 1948, *the Government Entomologist, in company with Mr. R. Leach, of the Cambridge School of Agriculture, spent two months, from mid-July to mid-September, in the B.S.I.P. The services of Mr. Leach had been retained by Messrs. Lever Bros., who have large coconut-planting interests in the Solomon Islands, to report on the incidence of premature nutfall of coconuts, and to make suggestions for its control. At the request of Messrs. Lever Bros., the Government of Fiji sent the Government Entomologist to work with Mr. Leach. Much interesting information resulted from the investigation, and it is hoped to publish a full account at a later date. In the meantime, this summary of the more important findings is submitted.* ED.]

Prior to the outbreak of World War II, the cause of premature nutfall had been shown to be puncturing of female flowers and young nuts by the Coreid bug *Amblypelta cocophaga* China. (The term "premature nutfall" as here employed, refers only to the really serious nutfall caused by this bug. Other forms of premature nutfall no doubt occur, but are of minor importance.) Pre-war workers had also shown that, where the yellow tree-ant, *Oecophylla smaragdina subnitida*, Emery, was well established, premature nutfall did not occur, as the ant destroyed or drove off *Amblypelta*. However, two other species of ants were stated to be capable of driving out *Oecophylla*. These were *Pheidole oceanica*, Mayr., and *Iridomyrme myrmecodiae*, Emery., and these two species had no deterrent effect on the bug. Consequently, where these ants were dominant, premature nutfall occurred, with drastic reduction in yield over large areas.

Very early in our investigation it was evident that the situation on some of the Guadalcanal plantations which had been seriously affected before the war had changed greatly. There was still a great deal of premature nutfall, but large areas which had previously suffered severely were now in bearing, or coming into bearing again. In these areas, *Oecophylla* had re-established itself.

An important observation made by Leach enabled us to trace the past history of the bug-population of palms, and inferentially the history of *Oecophylla* population. He noted that, when the bug sucks the growing tissue of a nut,—under, or near the distal edge of the bracts,—and the nut subsequently continues to grow, the puncturing causes large, conspicuous cracks on the surface of the nut. These characteristic lesions were observed in the field, and reproduced on a growing nut about 20 weeks old, on which caged bugs were fed. As the nut grows, the lesions move further from the base, usually occurring in a horizontal row, due to a series of punctures. Hence the presence of mature, scarred nuts at the base of a healthy palm indicated a past infestation of *Amblypelta*, which had been cleared up by the influx of *Oecophylla*. Similarly, the position of the lesions on scarred immature nuts permitted an estimate of the time when puncturing by the bug had occurred. Leach found that a growing nut increased in length by about an inch during the period between the bursting of successive spadices. This period had been found by Phillips to be about 23½ days. The marks are originally made by punctures through, or at the edge of the calyx, so that if marks are found to be three inches below the calyx, puncturing occurred about 70 days previously, and so on.

Using this method of tracing the history of palms, comparing pre-war reports with our own observations, and using information obtained from local planters, we could see that *Oecophylla* had regained much territory, probably during the preceding two or three years. On one plantation, where

large areas of palms were bearing extremely well, local observers unanimously stated that recovery from premature nutfall had occurred only during the preceding twelve months.

Why had such a great change come about, when pre-war investigators had stated that *Oecophylla* was steadily being driven out by the ant *Pheidole*? After considering all the available evidence, we reached the conclusion that *Oecophylla* had been favoured by the undergrowth which developed in the Guadalacanal plantations during the War. Before the War, Lever's plantations had been kept very clean, cattle being grazed, and all fallen fronds being burned. Thus the floor of the plantations was a clean mat, consisting mainly of Japanese Clover (*Desmodium* sp.). During the war, work on the plantations ceased, and the cattle were removed, though large areas were kept clean for a period by extensive encampments of American troops. At the time of our visit, the floor of the plantations was covered with dense undergrowth, including many creeping vines.

As is well known, *Oecophylla* makes its nests in trees and shrubs, webbing the leaves together by using its larvae as shuttles. Favoured trees for nesting are species of *Citrus* and *Ficus*. In coconut plantations, nests are commonly made on the fronds and in the spadices of the palms. *Pheidole* commonly nests at the base of the palms, a favoured spot being among the aerial roots under the " apron " of " bark ". *Oecophylla* forages far afield, its habit being to use definite pathways along the runners of vines, or along wire fences, telephone lines and the like. Attempts had been made before the war to establish *Oecophylla* in *Pheidole*-held territory by introducing nests of the former, and providing pathways of twine connecting the trunks of palms. These attempts had met with little success.

Our reconstruction of the decline and recovery of *Oecophylla* on the plantations was as follows: Before the war, the absence of vines and fallen fronds at the base of the palms had compelled the tree-ant, when ascending or descending, to cross over the strongholds of *Pheidole*. This led to its being destroyed by overwhelming numbers of the enemy. In the Russel Islands, where one plantation had been kept clean during the war by a concentration of cattle, this process could be seen in operation. Large numbers of *Oecophylla* could be observed milling around just above the basal portion of the trunk, unable to descend because of the *Pheidole* colonies below. With the return of vines and fallen fronds at the base of the palms during the war, *Oecophylla* was enabled to by-pass the *Pheidole* nests, and thus could re-establish itself in territory from which it had been ousted.

Several experiments were carried out in the re-establishment of *Oecophylla* in bad nutfall areas held by *Pheidole*; and during the period of our sojourn in the Solomons they proved successful. Our methods differed from those of pre-war workers in that we provided the vital bridge over the nests of *Pheidole* at the base of the palms. Nests of *Oecophylla* were placed on palms which were connected to neighbouring palms by lines of fallen fronds lain along the ground. The bridge consisted of portions of fronds leaned against the trunks, distal end upmost, and sometimes secured by twine a few feet above the ground. Colonies of *Oecophylla* so introduced appeared to hold their own, and exerted an almost immediate effect in control of premature nutfall. There seemed good reason to hope that they would multiply and spread to neighbouring areas.

Where *Iridomyrmex myrmecodiae* is the dominant ant, as in large areas of plantations on the island of Malaita, the problem of re-establishment of *Oecophylla* is much more difficult, as *Iridomyrmex* nests in vast numbers in all parts of the palms. Almost all of the *Oecophylla*-held palms in this area had nests of *Pheidole* at the base, and a well-established cover-crop of *Pueraria* sp. provided runways for the tree-nut. It appears that, in the case of these palms, *Pheidole* may have prevented *Iridomyrmex* from occupying the palms, and thus permitted *Oecophylla* to exist. However, there was no definite indication that *Pheidole* is capable of evicting *Iridomyrmex* from an area held by the latter ant.

The identity of the species of *Pheidole* concerned in the nutfall problem is of interest. Pre-war workers referred to it as

Pheidole oceanica, Mayr.; but an extensive collection of specimens from Guadalcanal, Malaita and the Russell Islands has been identified by Mr. J. Clark, the authority on Australasian ants, as *Pheidole megacephala*, Fabr. A colony of ants taken at the base of a coconut palm, and some specimens taken in the jungle near a plantation boundary, both in the Russell Islands, were identified by Mr. Clark as *Pheidole oceanica*. These two species could not be confused in the field, as *P. oceanica* is red, compared with the dark brown of *P. megacephala*, and is also somewhat larger than the latter. Undoubtedly the species which is found in great numbers throughout nutfall areas is *P. megacepahala*, which it is believed has not previously been recorded from the main islands of the B.S.I.P., though there is a record of its presence in the isolated Santa Cruz Islands. It appears that pre-war investigators confused the two species of Pheidole, as Pagden and Lever describe *P. oceanica* as "dark brown" and "dark fuscous", a description which fits *P. megacephala*, but not *P. oceanica*. Mann, in 1919, recorded *P. oceanica* as common in the B.S.I.P. but did not record *P. megacephala*. Hence it appears that the latter ant has become established since that time, and has driven out *P. oceanica*.

Experiments in control of the injurious species of ants were carried out. It was found that chlordane emulsion and DDT dissolved in dieseline were both extremely effective in killing colonies of both *Pheidole* and *Iridomyrmex*. A knapsack sprayer was used in the tests, and consequently control of *Iridomyrmex* in the upper portions of palms could not be attempted. After a single spraying of the lower portion of palms with chlordane, no *Iridomyrmex* were seen for a period of three weeks, but they still survived in the crown, and subsequently resumed activities on the trunk.

Recommendations for control, and for further investigation of the problem have been made, but these will not be dealt with here. As mentioned above, it is hoped to publish at an early date a full account of the investigation.

GENERAL REFERENCES.

China, W.E.—B.E.R., Vol. 25, P. 187.
Lever, R. J. A. W.—B.S.I.P.Agric.Gaz.Vol. 1 Pt. 3, p. 2
" — ibid Vol. 1 Pt. 4, p.15
" — ibid Vol. 3 Pt. 2, p. 6
" — ibid Vol. 3 Pt. 3, p. 2
" — ibid Vol. 3 Pt. 4, p. 9
Lever, R. J. A. W. and Phillips, J. S.—B.S.I.P. Agric. Gaz. Vol. 3 Pt. 4 (Suppt) p. 4.
Mann, W. M.—Bull, Mus. Comp. Zool. Harv., 63, No. 7.
Pagden, H. T. and Lever, R. J. A. W.—B.S.I.P. Agric. Gaz. Vol. 3, Pt. 1, p. 19.
Phillips, J. S.—B.E.R. Vol. 31, p. 295.
Wheeler, W. M.—Bernice P. Bishop Museum, Occasional Papers, Vol. XI No. 11.

ON THE ESTABLISHMENT OF SCOLIA RUFICORNIS IN WESTERN SAMOA FOR THE CONTROL OF THE ASIATIC RHINOCEROS BEETLE ORYCTES RHINOCEROS L.

BY HUBERT W. SIMMONDS, O.B.E.
LATE GOVERNMENT ENTOMOLOGIST, FIJI

On February 8th of this year the writer received a cable from Apia to say that twenty to thirty *Scolia ruficornis* had been observed at 10 a.m. on the 6th flying swiftly about a compost heap. This was followed by a specimen of the wasp, sent for confirmation of identification, and a note that this compost heap was twenty miles from the point of liberation. The above specimen was a male, as would be all those observed at that time and would indicate that there were, at least, an equal number of females within the heap.

History.—Oryctes rhinoceros was first observed in Samoa in September 1910 and spread rapidly.

In April 1912 F. P. Jepson, then Government Entomologist, Fiji, visited the island and reported on the position.

In 1913 Dr. Karl Friedrichs made a world tour searching for suitable parasites and recommended introduction of *Scolia oryctophaga* known to attack various species of *Oryctes* in Madagascar. In 1933 the writer visited Western Samoa and reported on the position.

About this time the Dutch obtained *Scolia oryctophaga* and shewed that it would breed on *Oryctes rhinoceros* but under Javanese conditions the pupal period became so extended (up to two years) that they were unable to maintain the colony.

In 1939 the writer undertook a mission to Malaya, Java, Mauritius and Madagascar to search for parasites. *Scolia ruficeps* had been recorded as such in Malaya, but the Javanese form of this was certainly not a parasite of *Oryctes* and it is suggested that the Malayan record indicates a biological strain, possibly the Burmese form, which, like the two specimens apparently bred from *Oryctes rhinoceros* is undoubtedly larger than the Javanese form. Tests were carried out with *Scolia patricialis* but without success and the local information that this wasp is a parasite of *Oryctes gideon* was accepted. The Americans have now shown that it can breed on *Oryctes rhinoceros*. As a result of study of the records, the writer came to the conclusion that the failure of *Scolia oryctophaga* in Java was due to the absence of a cool check and, as such, was not very hopeful for Samoa. No other parasite, however, being known, he shipped and successfully landed 210 adult females of this wasp in Apia. As feared, it failed to make good. Whilst in Mauritius he was informed that in the Zanzibar Museum *Scolia carnifax* was recorded as a parasite of certain *Oryctes*. Tests in Mauritius showed that this was not correct.

On arrival in Zanzibar, however, he found the wasp was not *carnifax* but a different species since identified by the Imperial Institute of Entomology as *Scolia ruficornis*. Tests indicated that this was indeed a true parasite of East African *Oryctes* and material collected in Singapore gave encouraging but not definite indications that it could use *Oryctes rhinoceros* as a host. Based on this the writer recommended its introduction.

In 1945 he was asked to undertake the work and successfully landed 465 adult females. Due to lack of knowledge of the habits of the insects when the work was commenced a good deal of scattering must have taken place and the succeeding population been very thin. Reports that it had been seen were discounted and fears were entertained that it had failed to make good. The cable received on February 8th removes all these doubts and indicates that the population is now considerable, with other foci probably scattered about. Indications were that in East Africa this wasp had a a very considerable effect in holding *Oryctes* in check and, relieved of certain enemies it would have in Africa, it should be even more efficient in Samoa, especially if suitable flowers can be provided at the right season for the adults and breeding places for the grubs accessible to the parasites.

ERRATA

Vol. 19 Nos. 3 and 4., p. 108, para. 2, after " It has also been found . ." please read " that the addition of a little fresh cod liver oil to the ointment results in the more rapid closing over wounds . ."

And, at the foot of p. 109, please read, after " painting it with iodine," " on two or three occasions at two or three day intervals."

* * *

COMMON COMPLAINTS OF DOGS IN FIJI—PART III—SKIN COMPLAINTS

The author of the above article (which appeared in Vol. 19 No. 2, p. 57) has suggested that an amplification of the final paragraph should be printed as follows:—

" Ointments containing up to eight per cent salicylic acid should be applied to the affected areas in dogs and followed by the daily application of zinc ointment for a further five or six days when a second application of the salicylic ointment can be used if the condition has not cleaned up. This should be followed by the zinc ointment as before.

Cats are more susceptible to the action of salicylic acid and should be treated with no more than a three per cent ointment and this is followed with zinc oxide as in dogs."

LIBRARY INFORMATION . . .

RECENT AGRICULTURAL PUBLICATIONS

RICE.

1. *Parboiling Treatment of Rice* by Dr. J. J. C. Hinton, *Nature*, No. 4128 Dec. 11, 1948.

An article dealing with the pre-milling treatment of padi known as parboiling, involving treatment of the unhulled rice with hot water and steam. This and similar methods which aim at improving the nutritive value of rice are given.

2. *Avoiding Vitamin Wastage in Rice Milling*—British Food Machinery Export Journal, Vol. 1 No. 1, Nov. 1948, 13.

A new British method developed by Thomas Robinson & Son Ltd.—"has made a complete departure from tradition with the new milling and whitening machines. The two machines form the backbone of an entirely new and scientific short system of milling rice with tremendous potentialities for it could ensure that the many millions of rice eaters received a greatly enhanced nourishment value from the same bulk of rice. From the nutritional point of view this would have the same beneficial effect as an increase in the rice crop itself."

3. *Rice as a Crop in Japan*—W. H. Leonard, Journ. Amer. Soc. Agron. Vol. 40, No. 7. July 1948, p. 579.

PEST CONTROL.

4. *Trials to determine the value of Certain New Insecticides as Preventives against Hide Beetles.*—J. R. Furlong, Bull. Imp. Inst. Vol. XLV, No. 4, Dec. 1947, 326.

Describes methods used, trials with DDT, Gammexane and sodium silicofluoride with tannery reports on the skins and the finished leather.

All three materials are shown capable of protecting skins against *Dermestes* attack when applied in suitable quantity and their use does not affect the handling or subsequent chrome tannage of the skins.

FOOD PROCESSING.

5. *The Manufacture of Jellies, showing Plant and Machinery required* (1) *Fruit Jellies*, (2) *Pectin*, (3) *Table Jellies.*—A. E. Williams in British Food Machinery Export Journal Vol. 1 No. 1, Nov. 1948, 2.

This article, which is well illustrated, reviews the different technique in present-day use in this sphere of industry.

COCONUTS.

6. *Notes on Manuring of Coconut Palms* M.L.M. Salgado, Tropical Agriculturist, Ceylon, Vol. 103, No. 2.

FODDER PLANTS.

7. *The Cultivation of Introduced Pasture Plants*—H. J. van Rensburg in East African Agric. Journ. Vol. 14 No. 1, 3.

This article lists the species of grasses and legumes established on experiment stations in the Union of South Africa, Southern Rhodesia, Kenya and Uganda: with notes on the climatic, soil and other factors most favourable to their growth. Species mentioned which also occur in Fiji are Rhodes grass, Kikuyu grass, Elephant grass, Guinea grass, Summer or Dallis grass and Vasey grass.

2. *Pasture Management*—H. J. van Rensburg, ib., p. 26.

The author discusses pasture utilization, rotational grazing and fencing, mowing of excess herbage and soil fertility and climate; and makes a plea for better use of indigenous species of pasture plants.

SOIL CONSERVATION.

9. *Soil Erosion in New Zealand, Part I*, Soil Bureau Bulletin No. 1, Department of Scientific and Industrial Research, N.Z., by L. I. Grange and H. S. Gibbs.

This is a fully illustrated report on the various types and classes of erosion in the North Island of New Zealand, studied in relation to vegetation and land use. There are four excellent maps.

GENERAL.

10. *Tropical Fruits: their Storage and Transport*—C. W. Wardlaw, Endeavour, Vol. 7 No. 25—1948.

11. *Asbestos Cement Materials in Farm Buildings*—M. V. Engelbach, Agricultural Engineering, Jan. 1948, p. 14.

FIJI AGRICULTURE AND FORESTRY AT THE SCIENCE CONGRESS.

The following officers of the Department attended the Seventh Pacific Science Congress held in Auckland and Christchurch during February:—

Messrs. W. J. Blackie, H. B. T. Hall, B.A. O'Connor and B. E. V. Parham.

The following are the titles of papers read by the official delegates and contributed by other members of the Department of Agriculture and by the Conservator of Forests.

C. Harvey: "Agricultural Development in Fiji."

W. J. Blackie: "Agricultural Policy and Research, Fiji."

H. B. T. Hall: "Dairying Industry in Fiji."

J. C. K. Marshall: "Problems of Forestry in Tropical Islands of the Pacific".

B. A. O'Connor: "Biological Control of Insects and Plants in Fiji".

B. E. V. Parham: "The Naturalized Flora of Fiji, with special reference to the Grasses, Legumes and Weeds".

L. E. Smythe: "Observations on Soil Science in Fiji."

B. E. V. Parham: "Co-operative Societies in Fiji".

* * *

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